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ABSTRACT

A nationwide survey was conducted to evaluate the effectiveness of college remedial mathematics programs. Questionnaires mailed to 200 two- and four-year remedial educators solicited information on teaching techniques, student evaluation, course offerings, faculty qualifications, classroom resources, math labs, time limits on remediation, follow-up studies, and the future of remedial programs. Study findings, based on a 73% response rate, included the following: (1) 82% of the colleges offered elementary algebra, 68% arithmetic, and 53% intermediate algebra; (2) most colleges did not offer credit for remedial courses; (3) the majority of the instructional faculty members held a master's degree in mathematics or math education; (4) the traditional lecture-discussion method was used by 74% of the instructors; (5) most instructors favored pencil-paper examinations; (6) the average class size was from 15 to 30 students; (7) 91% of the colleges provided tutorial services; (8) 42% of the remedial students finished developmental programs within 15 weeks; and (9) 46% to 75% of the remedial students successfully completed at least one college-level math course after remediation. (LL)

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COLLEGE DEVELOPMENTAL MATHEMATICS

--A NATIONAL SURVEY--

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Running Head: College Developmental

COLLEGE DEVELOPMENTAL MATHEMATICS

---A National Survey---

The failing of the "Three R's" at all levels of education has created chaos within our post-secondary educational system. An influx of students with a wide range of deficiencies, due to the open-door admission policy, are enjoying greater access to, and are enrolling in, colleges and universities.

After two decades of growth of remedial programs, the colleges continue to struggle with academic difficulties contributed by the diversity of students, such as entering recent high school graduates and older, returning students. This remedial program trend seems to be gaining more momentum, and the population of students needing to remediate is, indeed, growing out of proportion. Remedial mathematics enrollment at four-year institutions of higher education increased seventy-two percent between 1975 and 1980, while total student population increased by only seven percent (Coleman & Selby, 1982). The report of the National Science Board indicated that twenty-five percent of mathematics courses are remedial in all public four-year colleges; and, more surprisingly, forty-two percent of all courses are being taught as remedial work at the junior or local community colleges (Myers, 1983).

In order to understand the effectiveness of the remedial mathematics program, a survey was conducted to obtain information on teaching techniques, student evaluation, course offerings, faculty qualifications, classroom resources and math labs, time

limits on remediation, follow-up studies, and the future of the remedial program. The questionnaire was mailed to the two hundred remedial educators who are Chairpersons of Developmental Studies Departments in the Georgia University System and also the mathematics instructors selected from the list of participants at the Conference of Remedial and Developmental Mathematics in College: Issues and Innovations held in New York City on April 9-11, 1981.

The questionnaire was sent during the fall quarter of 1982. 146 or 73% of the responses were received prior to March 1, 1983. Nine or 4.5% of the surveys were returned after the cut-off date and, thus, were excluded from the study. Two of the questionnaires were returned unopened due to the lack of forwarding addresses. The survey covered all sections of the United States. From the data, it can be assumed that a broad representation of remedial students are being served by remedial mathematics faculties who responded to the survey. Table 1 shows the information concerning the returned responses.

Insert Table 1 about here

Course Offerings

Table 2 reveals the contents of remedial math in college. A majority of the schools do not offer credit for remedial courses toward graduation. In several colleges, two to three credit hours are given for completion of remedial work. Most of the schools offer elementary algebra--one of the most popular remedial courses. In some colleges, pre-calculus courses, such as college algebra and trigonometry, are credit courses. However, in a few prestigious universities, percalculus courses are remedial.

The survey showed that remedial mathematics courses vary from college to college, but most colleges' remedial course offerings consist of arithmetic, elementary algebra, and intermediate algebra.

Insert Table 2 about here

Teaching Faculties

Table 3 shows the backgrounds of the faculties who are mainly responsible for teaching remedial mathematics in colleges. The majority of the faculties hold a master's degree in math education of mathematics. The rest of the faculties hold either bachelor or doctoral degrees.

Insert Table 3 about here

Teaching Methodology

The traditional lecture-demonstration method is the most popular method of the remedial math teaching faculties. Individualized methods, such as computer-assisted programs, self-paced type programs, small-group settings involving lecture and discussion are increasingly being used by faculties in all sections of the United States.

Table 4 shows a comparison of teaching methods in colleges.

Insert Table 4 about here

Evaluation of the Students

A majority of the faculties favor the pencil and paper examination. Some colleges encourage their students to use computers to master their learning, so that they will have limited opportunities to practice before a formal examination. A few faculties apply the mastery concept to allow students more than one chance to repeat the test.

Classroom and Math Lab

In some colleges, a large lecture class of more than two hundred people is provided twice a week. For the remainder of the week, students go to learning centers or math labs for a scheduled time of individual or self-paced learning. During this time, the instructor is available to fill individual needs.

In most of the schools, the average class size is from fifteen to twenty-five students. Table 5 shows the average size of a remedial class.

Insert Table 5 about here

For the students of regular remedial classes, the extra help outside the classroom is available. Ninety-one percent of the colleges provide tutorial service where students can get individual attention. A few larger community colleges are equipped with a computer-assisted laboratory which is open daily to the students to meet their needs. Some colleges are staffed with math major assistants who serve as tutors. Fifty-eight percent of the schools also provide scheduled help sessions. Fifty-two percent of the schools have unscheduled tutorial services. In sixty-one percent of the schools, the instructors are available for tutorial help. Fifty-eight percent are staffed with student tutors. Forty-six percent are equipped with full time math lab staffs that provide individual help during school hours. Most math labs provide slides, games, cassettes, individualized materials, computer terminals, and drill exercises for student use. Table 6 is a summary of the teaching aids in learning centers and math labs across the nation.

Insert Table 6 about here

Textbooks

Conventional textbooks are the most prevalent among the remedial class surveyed. Table 7 shows the percentage of types of textbooks used.

Insert Table 7 about here

Time Limit for Remediation

Students in the remedial programs who do not complete required remedial study courses within specified time limits are not allowed to continue the remedial programs of the colleges. They are suspended for at least one quarter or semester.

Eighteen percent of the remedial students have an average length of ten weeks or less to finish developmental math successfully, according to the survey. Forty-two percent finish within fifteen weeks. Twenty percent take up to two quarters and another twenty percent take more than two quarters to finish. Table 8 shows a summary of students' performances.

Insert Table 8 about here

Follow-Up Studies

What happens after the remedial students exit from the remedial programs? Do they continue with regular college math courses? What is the success rate when they enroll in college level math courses?

Forty-two percent of the schools reported that fifty-one to seventy-five percent of the remedial students successfully complete at least one college level math course. Twenty-six percent of the schools reported that forty-six to fifty percent of the remedial math students eventually complete one college level math course successfully.

Some colleges conduct intensive studies on the performance of the remedial students. From the survey, they report that the students who have completed remedial training are better than the regular students in terms of retention rate or success rate.

Developmental Studies Department

In some states, a separate department trains the remedial students. But in most states, the remediation is provided by the academic departments.

The advantage of a separate remedial department is that is provides a professional, adequate staff whose time is devoted exclusively to the remedial students in order to help build a solid educational foundation. However, a separate remedial department is only as good as the people who staff it. In order to have the best qualified instructors, the remedial department has to co-ordinate closely with the mathematics department and employ the best possible teachers to teach remedial courses.

Some suggestions have been made for incorporating the academic skill courses in traditional departmental offering. This could createthe possibliity of a serious lack of well-qualified teachers, due to the fact that a majority of full-time mathematics instructors are reluctant to teach remedial mathematics. Because of this, most of these courses end up being taught by part-time, inexperienced instructors or graduate student assistants. This weakness can be corrected by making the faculty aware of the importance of staffing with the best available instructors to teach remedial mathematics, thus benefitting the students as well as the school and its mathematics program.

Rotating the instructors to teach remedial mathematics could be another way to staff remedial level courses. The instructors would be able to recognize and understand their students through close contact. Instructors would become more aware of the quality of students and their learning patterns. The instructors would also have a chance to adjust their teaching to this level of student. It would be advantageous to the students in that they would have continuity of instruction throughout the entire program.

Conclusion

--Future of Remedial Programs--

This survey showed the remedial program gaining more attention in higher education systems across the nation. This program, created by two decades of failure in the public school systems, will produce more problems and chaos in our school systems. Among these will be (1) the "Don't care" attitudes in high school toward studying because students will think they will get a "second chance" in college, and (2) the massive amounts of money poured into a program which duplicates educational expenditures, deepening the already unhealthy financial situation in our public education system.

A recommendation for eventual elimination of the Developmental Studies Program in the University System of Georgia is included in a document titled "The Eighties and Beyond--A Commitment to Excellence", which was adopted by the Board of Regents at the February meeting for use as a planning guide (System Summary, 1983). This recommendation stipulates, however, that this goal is long-range in nature.

The Governor's Commission on Secondary Schools in Florida has recommended that public colleges and universities be prohibited from teaching remedial courses after 1985. They propose that such courses be offered in the high schools during the summer and in adult education programs (Myers, 1983).

Besides Florida and Georgia, several other state systems of higher education such as Kentucky, Mississippi, and Virginia, that allocate massive state funds to remedial programs, plan to phase out such funding to all but a few open-door institutions in the future (Myers, 1983).

All over the country, the remedial problem is epidemic. The Ohio State University, which has guaranteed entrance to any Ohio high school graduate since 1902, now enrolls unconditionally only those students who have finished a college-preparatory curriculum in high school. The University of Tennessee is planning to tighten admission requirements to reduce the student population. In California, high school graduates will not be able to attend one of California's colleges or universities without some restrictions. At the 170,000-student City University of New York there are no plans to cut back open admissions, but the incoming freshmen have to take an achievement test in reading and a specially developed freshman assessment test. Half of their students require special assistance. They do not receive credit for remedial courses (McGrath, 1982).

Disregarding the uncertain long-range plans concerning higher education's remedial programs across the nation, community colleges will continue to enroll some underprepared students.

It is easy to foresee that the high-technology society will require more technology-oriented students, and, unless the high school curriculum changes, remedial education will definitely exist in post-secondary institutions with a shift to learning centers, adult educational centers, continuing education programs, and public school summer programs. With the assistance of computer-assisted learning, a low-cost tutorial program or instructional-aid service will be available for anyone who would like to learn mathematics.

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Footnotes

This paper was presented by the author to the Annual Convention of Mathematical Association of America, Southeastern Section at The Citadel, Charleston, South Carolina, on April 15-16, 1983, under the title, "Teaching Remedial Math in College. Is It Possible?". A more detailed version was presented to the Developmental Study Conference, University System of Georgia, at Georgia State University, Atlanta, Georgia, on April 22-23, 1983.

This paper was delivered by the author at the AMATYC National Convention under the title "Proficiency: The Remedial Challenge" on November 10-12, 1983 at Orlando, Florida.

Table 1

DISTRIBUTION OF RESPONSES

South	35%
Middle Atlantic	13%
Midwest	15%
Far West/Alaska	9%
Northeast	14%
Southwest	14%

LOCATION OF INSTITUTIONS

Metropolitan Area	51%
Rural Area	49%

TYPE OF INSTITUTIONS (HIGHEST DEGREES OFFERED)

A.A. Degree	56%
B.A. Degree	17%
Masters Degree	14%
Doctoral Degree	13%

ENROLLMENT OF THE INSTITUTIONS

Under 2000	28%
2000-5000	20%
5000-10,000	25%
Over 10,000	27%

Date of Compilation--March 1, 1983

Table 2

COLLEGE REMEDIAL MATHEMATICS COURSE OFFERINGS

Content of Courses	Percentage of Colleges That Offer the Course
Arithmetic*	68%
Elementary Algebra**	82%
Intermediate Algebra	53%
Combined Arithmetic & Algebra	32%
Geometry (Plane)	15%
Others***	20%

Date of Compilation--March 1, 1983

*In some colleges, this is the only remedial mathematics course.

**Some colleges offer credit for this course. In some colleges, all courses above elementary algebra may be used as credit in their technical program.

***Pre-calculus, business math, health math, occupational math, calculator math, etc.

Table 3

EDUCATIONAL BACKGROUND OF INSTRUCTORS
WHO TEACH REMEDIAL MATH COURSES

Degree Held	Percentage of Faculty That Hold the Degree
Master in Math	51%
Master in Math Education	55%
Ph.D in Math or Math Education	33%
Others*	28%

Date of Compilation--March 1, 1983

*Bachelor degree in Math, Bachelor degree in Math-oriented courses, Bachelor degree in Math Education, and Doctoral or Master degree in Math-related science courses

Table 4

TEACHING METHODS

Methods	Percentage of Faculties Using The Method
Traditional Lecture-Demonstration	74%
Self-Paced Type (Informal Class)	26%
Lecture-Demonstration Self-Paced (Formal)	34%
Laboratory Type	40%
Others *	5%

Date of Compilation--March 1, 1983

*Use of tapes and filmstrips, etc.

Table 5

AVERAGE REMEDIAL CLASS SIZE

Average Class Size	Percentage of Colleges With This Class Size
Less Than 16	4%
16-20	24%
21-25	22%
26-30	22%
31-35	15%
More Than 35	11%
Not Applicable*	2%

Date of Compilation--March 1, 1983

*No formal class scheduled--individualized, self-paced learning setting

Table 6

TEACHING AIDS IN LEARNING CENTERS OR MATH LABS

Teaching Aids	Percentage of Colleges With This Aid
Tapes	48%
Slides	20%
Movies	10%
Programmed Books	44%
Computer	23%
Electronic Calculator	37%
Others*	14%

Date of Compilation--March 1, 1983

*Inhouse written materials to supplement text, videotapes, drill sheets, chapter review sheets

Table 7

TEXTBOOKS

Texts	Precentage of Colleges With This Type of Text
Programmed Type Text	33%
Coventional Text	68%
Own Written Notes	11%
Others*	8%

Date of Compilation--March 1, 1983

*Department-published text, cassette types of learning materials, non-programmed workbooks

Table 8

SUMMARY OF STUDENT PERFORMANCE

Average Length to Finish Developmental Math Successfully	Percentage of Students Who Finish at This Time
8-10 weeks	18%
11-15 weeks	42%
16-20 weeks	20%
More than 20 weeks	20%

Date of Compilation--March 1, 1983

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